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Patentanmeldung Nr. Patent application No. Demande de brevet n°

03076127.4 ✓

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R C van Dijk

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Bezeichnung der Erfindung/Title of the invention/Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
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System for pulse detection and method for pulse detection

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System for pulse detection and method for pulse detection

The invention relates to a communication system comprising a transmitter and a receiver, said transmitter being arranged for transmitting transmission signals comprising pulses of a pre determined time dependent level and duration, the receiver being arranged for detecting the pulses in the transmission signals.

The invention further relates to a receiver for use within a communication system.

The invention further relates to a method of communication between a transmitter and a receiver, said transmitter being arranged for transmitting transmission signals comprising pulses of a pre determined time dependent level and duration, the receiver detecting the pulses in the transmission signals.

Such a communication system is disclosed in the International patent application published under number WO 00/93444A1. The known communication system is a ultra wide band (UWB) communication system. The known communication system has an UWB receiver that synchronizes with a transmission signal transmitted by an UWB transmitter. A local pulse generated at the receiver is correlated with the transmission signal. The value in the correlation function that corresponds to a high signal to noise ratio is found. Thereby the receiver is matched to the phase of the transmission signal, and the receiver is operated at that phase.

Disadvantage of the known communication system are that locking of the UWB receiver to the incoming signal may take a long time and that an accurate timing generator is required.

Amongst others it is an object of the invention to reduce the required hardware to detect a pulse in a transmission signal.

To this end the invention provides a communication system as defined in the opening paragraph which is characterized in that the receiver comprises a plurality of trigger

elements, each of the trigger elements being operative to generate a trigger signal in dependence on the pulses, a reference signal with a settable reference level and a timing signal with a settable timing delay.

To detect a pulse in the communication signal at a certain point in time, the knowledge on the expected arrival time and amplitude of the pulse is used to trigger the trigger elements. Both the reference levels and the timing delays are set in accordance with the with the expected pulse shape and arrival time. By the settable reference levels and timing delays the accurate timing generator present in the known communication system is not required. This results in a reduction in required hardware.

An additional advantages of the communication system according to the invention is a reduction in power consumption, caused by the absence of the accurate timing generator.

The above and other objects and features of the present invention will become more apparent from the following detailed description considered in connection with the accompanying drawings in which:

Fig. 1 schematically shows an embodiment of the receiver for use in the communication system according to the invention;

Fig. 2 shows a diagram indicating the timing-level diagram corresponding to the embodiment of the communication system shown in Fig. 1; and

Fig. 3 schematically shows an embodiment of the trigger elements within the receiver for use in the communication system according to the invention.

Fig. 1 schematically shows an embodiment of the receiver for use in the communication system according to the invention. The pulse detection system has a number of trigger elements in the form of comparators (e.g. latches with optional pre-amplifiers) of which both the reference levels and the timing can be programmed.

To detect a pulse at a certain point in time, the knowledge on the expected arrival time and amplitude of the pulse is used to activate a series of latches: both the reference levels and the timing delays are programmed according to the expected pulse shape and arrival time. In this way hardware and power is saved at the expense of a programmable timing and reference level for the latches.

Fig. 2 shows a diagram indicating the timing-level diagram corresponding to the embodiment of the communication system shown in Fig. 1. If no information on the pulse is available, the amplitude and timing can be arranged in a uniform way. If information on the arrival time and amplitude is available, the timing and levels are programmed to obtain the highest possible probability of detection.

The delay clock pulses for the latches at T0 to Tn can be derived from a timing delay generator (e.g. a Delay Locked Loop), and is triggered by a trigger signal. For each timing point, at least one latch is activated with a reference level selected from a range L-m to L+m.

The way the number of latches is divided over the time delay points and the amplitude levels depends on the expected pulse and its modulation. This method can be applied to different types of modulation such as Pulse Position Modulation, bi-phase modulation, pulse amplitude modulation. If no information on the expected pulse is available in the receiver (e.g. during locking, when a first pulse has to be detected) one could start with relative high reference levels and gradually decreasing them until the strongest pulse is detected.

Once the pulse amplitudes and expected positions are known, an optimal combination of time points and amplitude levels is programmed to detect the information in the pulse with the highest probability (best SNR) as well as to optimize the prediction of time and amplitude of the next pulse (some more detailed implementations can be added if required). The programming can be adapted to different modulation formats by simple reprogramming of levels and timing resulting in very flexible receiver.

The actual latches need a very fast reaction time but have plenty of time for reset (asymmetric, compared to requirements in traditional high speed ADCs).

For latches, the acquisition time is very small (50 psec), while conversion and resetting time can be much larger (several nsec). These requirements become easier with reducing CMOS feature size.

The latches and preamplifiers can be sharing the same bias current and are biased only a limited time before the latching period and hence limit the power dissipation.

Fig. 3 schematically shows an embodiment of the trigger elements within the receiver for use in the communication system according to the invention. In this embodiment the references are derived from a resistive ladder and the timing instances are generated by a combination of a VCO (locked by PLL to external reference) and a DLL for the fine delays that are required. A possible implementation of the latch is also shown.

The embodiments of the present invention described herein are intended to be taken in an illustrative and not a limiting sense. Various modifications may be made to these embodiments by persons skilled in the art without departing from the scope of the present invention as defined in the appended claims.

For instance, additionally a variable gain can be built in the reference generator: the reference levels can be scaled to accommodate varying input signal levels. This can be implemented by realizing the references by means of a multiplying DAC converter.

In summary a communication system is disclosed with a receiver comprising a pulse detection system that makes use of available information in the receiver on the expected pulse to set the timing and levels of a series of trigger elements, for instance comparators. In this way the latches can be optimally used under all circumstances and the power dissipation can be reduced. Moreover this system is very flexible as it can handle different modulation formats by simple reprogramming of levels and timing. The communication system may used advantageously in UWB applications.

CLAIMS:

1. A communication system comprising a transmitter and a receiver, said transmitter being arranged for transmitting transmission signals comprising pulses of a pre determined time dependent level and duration, the receiver being arranged for detecting the pulses in the transmission signals, characterized in that the receiver comprises a plurality of trigger elements, each of the trigger elements being operative to generate a trigger signal in dependence on the pulses, a reference signal with a settable reference level and a timing signal with a settable timing delay.

2. A communication system as claimed in claim 1, characterized in that the settable reference levels of the reference signals are generated by a reference level generator.

3. A communication system as claimed in claim 1 or 2, characterized in that the settable timing delays of the timing signals are generated by a timing delay generator.

4. A communication system as claimed in claim 1, 2, or 3, characterized in that the trigger elements are comparators being operative for comparing the level of the pulses with the reference level, said comparators being enabled by the timing signal.

5. A communication system as claimed in claim 1, 2, 3, or 4, characterized in that the receiver further comprises a signal processor being operative for detecting the presence of the pulse in dependence on trigger signals generated by the trigger elements.

6. A communication system as claimed in claim 5, characterized in that the signal processor is further operative to control the settable reference levels generated by the reference level generator.

7. A communication system as claimed in claim 6, characterized in that the signal processor is further operative to control the settable timing delays of the timing signals generated by the timing generator.

8. A receiver for use within a communication system as claimed in claim 1.

9. A method of communication between a transmitter and a receiver, said transmitter being arranged for transmitting transmission signals comprising pulses of a pre determined time dependent level and duration, the receiver detecting the pulses in the transmission signals, characterized in that the receiver comprises a plurality of trigger elements, each of the trigger elements generating a trigger signal in dependence on the pulses, a reference signal with a settable reference level and a timing signal with a settable timing delay.

ABSTRACT:

The invention relates to a communication system comprising a transmitter and a receiver, said transmitter being arranged for transmitting transmission signals comprising pulses of a pre determined time dependent level and duration, the receiver being arranged for detecting the pulses in the transmission signals, characterized in that the receiver comprises a plurality of trigger elements, each of the trigger elements being operative to generate a trigger signal in dependence on the pulses, a reference signal with a settable reference level and a timing signal with a settable timing delay.

Fig. 1

Figures

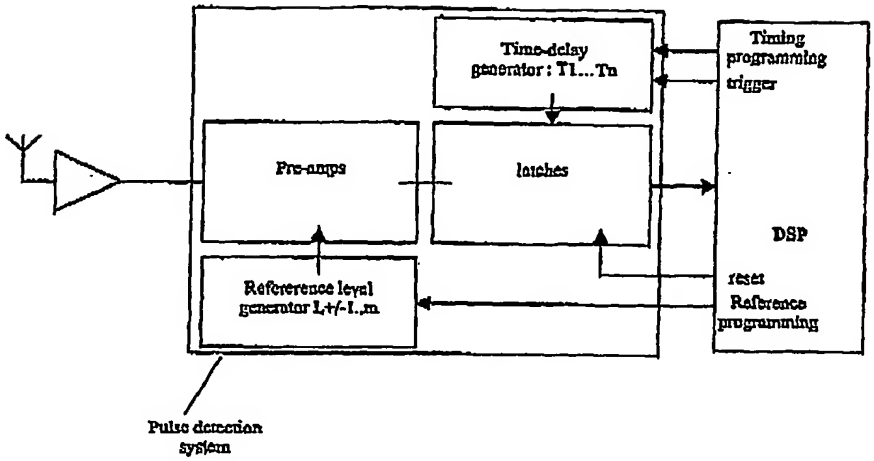

Fig. 1

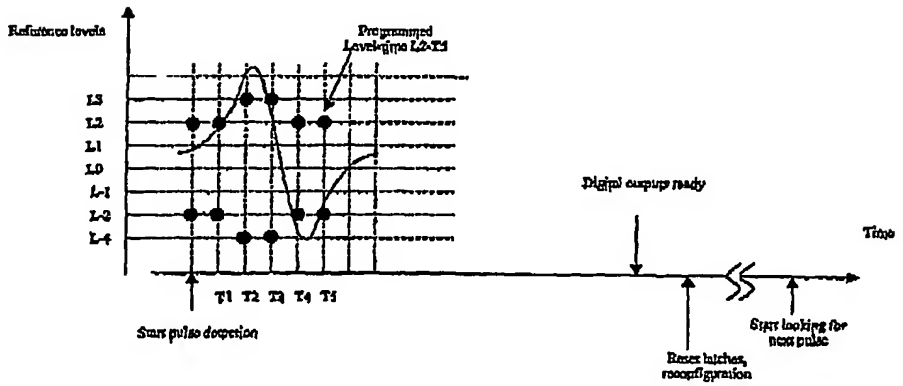

Fig. 2

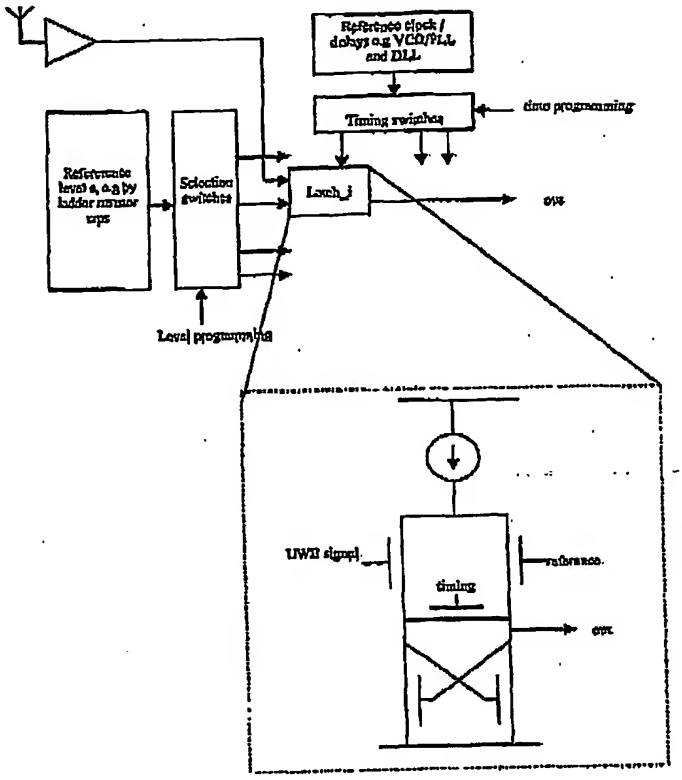
Reference clock / delays e.g VCO/PLL and DLL
Timing switches
time programming
Reference levels e.g by ladder resistor taps
Selection switches
Latch_i
out
Level programming
UWB signal
timing
reference
out

Fig. 3